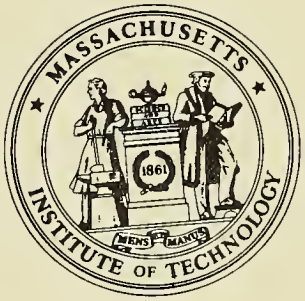
BASEMENT



LIBRARY
OF THE
MASSACHUSETTS INSTITUTE
OF TECHNOLOGY

Digitized by the Internet Archive
in 2011 with funding from
Boston Library Consortium Member Libraries

http://www.archive.org/details/smugglinginterna00bhag

M.I.T. TECH.
Sept 1972

working paper
department
of economics

SMUGGLING AND INTERNATIONAL TRADE THEORY

by

Jagdish Bhagwati and T. N. Srinivasan

Number 93 September 1972

massachusetts
institute of
technology

50 memorial drive
cambridge, mass. 02139

SMUGGLING AND INTERNATIONAL TRADE THEORY

by

Jagdish Bhagwati and T. N. Srinivasan

Number 93 September 1972

The research for this paper was supported by the National Science Foundation. The views expressed here are the authors' sole responsibility and do not reflect those of the Department of Economics nor of the Massachusetts Institute of Technology or the National Science Foundation.

75 SBURY 13 061 BB 5542
QUALITY CONTROL MARK

Smuggling and International Trade Theory

Bhagwati and Hansen [2] have shown that the phenomenon of smuggling in an open economy can be incorporated readily into standard trade-theoretic analysis by treating smuggling as essentially involving a less favourable transformation curve insofar as smuggling involves a real cost.*

In this paper, we utilise the same analytical device and extend the Bhagwati-Hansen analysis to a number of other issues traditionally considered in the theory of international trade. We use the same analytical simplifications:

i) Smuggled goods and legal imports are cleared at the same final price: consumers do not discriminate in their purchases between the two sources of supply.

ii) Changes in social welfare are analysed by reference to a standard Crusoe-type social utility function defined on the current availability of goods and services.

iii) Goods constituting consumption and directly entering the utility function are smuggled, and not bads (e.g. heroin) or assets (e.g. gold): the model used for our analysis is the traditional trade-theoretic model where non-traded primary factors produce traded final goods entering the utility function.

iv) Expenditure on enforcement of the tariff is held implicitly constant in comparing the tariff-with-smuggling and tariff-without-smuggling situations and is not explicitly considered, in keeping with the tradition

---

*This real cost arises insofar as the avoidance of normal trade channels leads to increased costs--e.g. more expensive transport and higher f.o.b. price for imports.

636251

of trade theory, in comparing either with the free-trade situation: one important effect is to rule out analysis of the possible trade-offs between increased enforcement expenditure and reduced smuggling.

v) Finally, the bulk of our formal analysis is based on the two-traded-goods model, though in the last section we consider the effects of having multiple traded goods.

Section I essentially re-derives the basic Bhagwati-Hansen propositions on the welfare effects of smuggling for the case where there is no monopoly power in trade. The later sections deal with questions that are interesting in the context of a country with monopoly power in (legal) trade and hence allow for it explicitly, though the small-country analytical results can naturally be derived as a special case. Section II derives the first-order conditions for an optimal solution when smuggling is possible and examines the set of policies that would yield this optimum. Noting that this set of policies is not operationally feasible in general, we proceed to examine therefore in Section III the following issues in the "second-best" domain where a tariff is the only policy instrument available. The following questions are considered:

i) How does the optimal tariff without smuggling--which is clearly the first-best policy instrument--rank with the optimal tariff with smuggling--which is clearly, in light of Section III, <u>not</u> a first-best policy instrument?

ii) How does the maximal-revenue tariff in the presence of smuggling compare with the optimal tariff in the presence of smuggling?*

iii) How does the maximal-revenue tariff in the presence of smuggling

---

*Harry Johnson [3] has shown that, without smuggling, the maximal revenue tariff is greater than the optimal tariff.

compare with the maximal-revenue tariff?

iv) Is the maximal revenue that can be collected with smuggling lower than the maximal revenue in the absence of smuggling?

v) For any given revenue, is the tariff rate with smuggling greater than the tariff rate without smuggling?

In Section IV, we consider the effect of smuggling on the Lerner Symmetry theorem. In Section V, the effect of smuggling on the theory of optimal policy structures is considered.

I

Consider a country with no monopoly power in trade, producing two goods at levels X_1, $G(X_1)$ when G is the transformation function ($G > 0$, $G' < 0$, $G'' < 0$ for $0 \leqq X_1 \leqq \bar{X}_1$). Assume perfect competition in domestic markets. Let foreign trade take place through two channels: legal and smuggler's. Let the first commodity be imported. Let the second commodity (exportables) be the numeraire. Let there be no production taxes or subsidies, nor consumption taxes or subsidies (other than tariffs).

Led p_d be the domestic price ratio and p_ℓ, p_s the foreign price ratios for legal trade and smuggler's trade. Let C_i be the consumption of commodity i. Let x_ℓ, x_s be the imports of commodity 1 through the legal and smuggler's channels respectively. Let $U(C_1, C_2)$ be the social utility function.

Now:

$$C_1 = X_1 + x_\ell + x_s \tag{1}$$

$$C_2 = G(X_1) - p_\ell x_\ell - p_s x_s \tag{2}$$

$$U_1 = p_d U_2 \tag{3}$$

$$-G'(X_1) = p_d \qquad (4)$$

The first two equations are commodity balance equations. Equations (3) and (4) follow from utility and profit maximisation under competition, given p_d and the budget and transformation constraints. There are in all eight unknowns: C_1, C_2, X_1, x_ℓ, x_s, p_ℓ, p_d, p_s. To determine an equilibrium, in general we need four more equations, describing the determination of p_ℓ, p_s and the relationship of the domestic price-ratio p_d to p_ℓ and p_s. To this we turn.

Case I: Legal Trade Eliminated by Smuggling

Consider a country with no monopoly power in trade, i.e. $p_\ell = \bar{p}_\ell$. Assume that it imposes a tariff at the ad valorem rate t and that the tariff succeeds in eliminating legal trade, i.e. $x_\ell = 0$. Assume further that there is perfect competition in smuggling, so that $p_s = p_d$. If smugglers face constant costs, then $p_s = \bar{p}_s$; otherwise $p_s = \frac{h(x_s)}{x_s}$ where $h(x_s)$ represents the exports of commodity 2 needed to be smuggled out for getting smuggled imports of commodity 1 at level x_s. We shall assume that $h(0) = 0$, $h' > 0$, $h'' > 0$, implying that p_s is an increasing function of x_s and $p_s < h'$. Thus the equations:

$$p_\ell = \bar{p}_\ell,\ x_\ell = 0,\ p_s = p_d,\ p_s = \bar{p}_s \quad \text{or}$$

$$p_\ell = \bar{p}_\ell,\ x_\ell = 0,\ p_s = p_d,\ p_s = \frac{h(x_s)}{x_s},$$

taken with (1)-(4), determine the equilibrium.

We now wish to compare the welfare level U^s achieved under smuggling with the welfare level U^t under the given tariff t with no smuggling. Clearly if the domestic price ratio p_d (= p_s) coincides with $\bar{p}_\ell(1+t)$, the tariff-

inclusive price of legal imports, then welfare without smuggling will be higher than that with smuggling. For, in this case, production levels are the same in the two situations, but smuggling involves inferior terms-of-trade compared to the tariff situation. Thus $U^s < U^t$ when $p_d = p_s = \bar{p}_\ell(1+t)$.

Let us now compute the derivation of U^s as $p_d = p_s$ falls <u>below</u> $\bar{p}_\ell(1+t)$.

$$\frac{dU^s}{dp_d} = U_1^s \frac{dC_1}{dp_d} + U_2^s \frac{dC_2}{dp_d}$$

$$= U_2^s [p_d \frac{dC_1}{dp_d} + \frac{dC_2}{dp_d}] \quad \text{using (3)}$$

$$= U_2^s [\frac{d}{dp_d}(p_d C_1 + C_2) - C_1]$$

$$= U_2^s [\frac{d}{dp_d}\{p_d X_1 + G(X_1)\} - C_1] \text{ , using } p_d = p_s,\ x_\ell = 0$$

$$= U_2^s [X_1 - C_1], \text{using (4)}$$

$$= -U_2^s x_s \text{ , using (1) and } x_\ell = 0$$

$$< 0$$

This implies that as p_d falls from $\bar{p}_\ell(1+t)$, U^s increases. If p_d falls to $\bar{p}_\ell$, we reach free trade equilibrium and hence $U^s > U^t$. Hence there exists a unique p_d^* such that $U^s = U^t$ and $U^s \gtrless U^t$ according as $p_d \lessgtr p_d^*$.

Thus, when legal trade is eliminated by competitive smuggling given the tariff, smuggling will improve welfare provided the smuggling-equilibrium p_d is below the critical value p_d^* and will worsen it for p_d above p_d^*.*

---

*It is clear that when the tariff is prohibitive so that the equilibrium in the absence of smuggling is one of autarky, p_d^* coincides with the autarky equilibrium price and hence smuggling, by setting p_d below p_d^*, necessarily improves welfare.

This proposition can be readily illustrated with the aid of the trade-indifference curve technique. In Figure (1), OI_f is the country's free-trade offer curve, OL the legal-trade offer curve facing it, and with the tariff at rate OM/MN, the tariff-ridden offer curve is OI_t. The country's trade-indifference curve touching the domestic tariff-inclusive price-ratio MR at R is TI_t. It follows that P_d^* is the smuggler's offer which, under smuggling, would bring the economy to the same welfare level TI_t at S. We can thus distinguish the following regions: (1) Zone I: where the smuggler's offer curve lies between OQ and OS: in this zone, smuggling clearly must improve welfare; (2) Zone II: where the smuggler's offer curve lies between OS and OW (= MR): here, smuggling will worsen welfare; (3) Zone III: where the smuggler's offer curve lies to the left of OW: in this case smuggling will cease and welfare will be unchanged, at level TI_t (at R).*

Case II: Legal Trade Co-existing with Smuggling

Assume now that, in the smuggling situation, legal trade is not eliminated. This case will arise only when $p_s = p_d = \overline{p}_\ell(1+t)$. When this is so, however, we have already seen that smuggling must result in inferior terms of trade and the consequent loss therefrom is maximal if smuggling replaces legal trade fully and is zero if smuggling does not occur--these two being the extreme possibilities in this situation. It follows that, in the smuggling situation, if the two forms of trade actually co-exist, the welfare level must be lower than in the non-smuggling situation.

---

*At OW, smuggling may be zero, in which case welfare will be unchanged; if finite smuggling occurs, as it can (because OW = MR), welfare will have reduced below the level in the absence of smuggling.

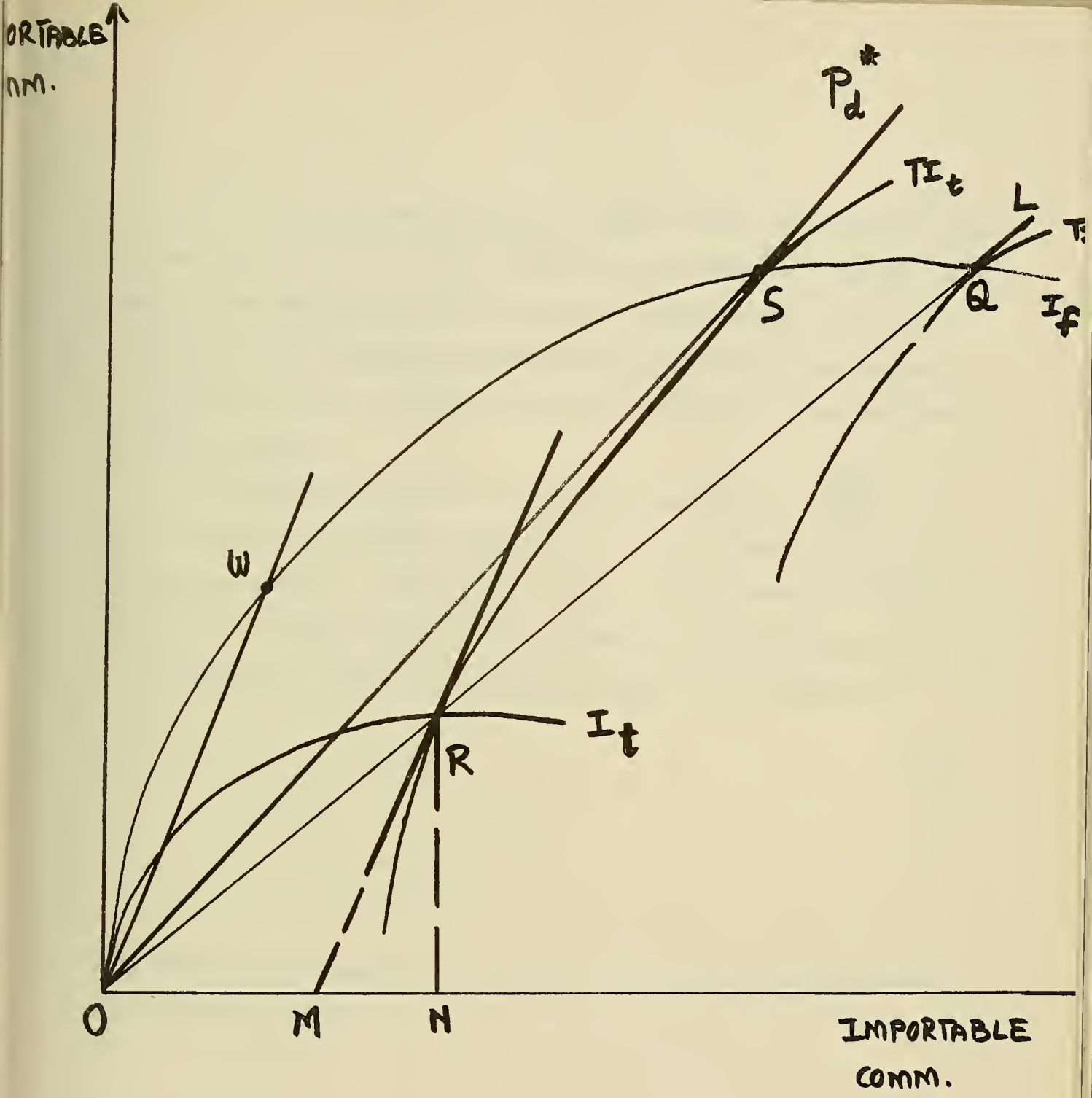


Figure (1)

II

Let us now admit monopoly power in (legal) trade. We shall then examine the conditions for a first-best solution in the presence of smuggling. Note that, without monopoly power, the first-best policy remains free trade--which means that the question of smuggling is irrelevant to the analysis: we demonstrate this as a special case of our analysis of the monopoly-power-in-trade situation.

To introduce monopoly power in trade, assume that $p_\ell = \frac{g(x_\ell)}{x_\ell}$ where $g(x_\ell)$ represents the exports of commodity 2 needed for getting imports of x_ℓ units of commodity 1 through legal trade. We shall assume that $g(0) = 0$, $g' > 0$, $g'' > 0$ implying that p_ℓ is an increasing function of x_ℓ and $p_\ell < g'$.

Consider the problem of maximising welfare $U(C_1,C_2)$ subject to:

$$C_1 \leqq X_1 + x_\ell + x_s \tag{5}$$

$$C_2 \leqq G(X_1) - g(x_\ell) - h(x_s) \tag{6}$$

$$C_1,\ C_2,\ X_1,\ x_\ell,\ x_s \geqq 0.$$

Maximising the Lagrangean $\Phi = U - \lambda_1[C_1-X_1-x_\ell-x_s]-\lambda_2[C_2-G+g+h]$, we get (for our interior solution):

$$U_1 = \lambda_1 \tag{7}$$

$$U_2 = \lambda_2 \tag{8}$$

$$\lambda_1 + \lambda_2 G' = 0 \tag{9}$$

$$\lambda_1 - \lambda_2 g' = 0 \tag{10}$$

$$\lambda_1 - \lambda_2 h' = 0 \tag{11}$$

$$\text{or } \frac{U_1}{U_2} = -G' = g' = h'. \tag{12}$$

In other words the marginal rate of substitution in consumption is equated to the marginal rate of transformation in production, in legal trade and in smuggling.

If we do not wish to rule out corner solutions we can rewrite (7)-(11) as follows:

$$U_1 - \lambda_1 \leqq 0 \quad \text{with equality if } C_1 > 0$$

$$U_2 - \lambda_2 \leqq 0 \quad \text{with equality if } C_2 > 0$$

$$\lambda_1 + \lambda_2 G' \leqq 0 \quad \text{with equality if } X_1 > 0$$

$$\lambda_1 - \lambda_2 g' \leqq 0 \quad \text{with equality if } x_\ell > 0$$

$$\lambda_1 - \lambda_2 h' \leqq 0 \quad \text{with equality if } x_h > 0.$$

One particular corner solution is of some interest. Suppose there is no monopoly power in legal trade, i.e., $g = p^f x$ where p^f is the fixed world terms of trade. Ruling out specialisation in consumption and production, the optimal solution will be characterised by free trade and no smuggling if:

$$U_1 = \lambda_1,\ U_2 = \lambda_2,\ \lambda_1 + \lambda_2 G' = 0,\ \lambda_1 = \lambda_2 g' = \lambda_2 p^f$$

$$\text{and } h'(0) \geqq \frac{\lambda_1}{\lambda_2} = p^f.$$

In other words, free trade will be the optimal policy in the absence of monopoly power in trade if, as we have assumed, the marginal terms of trade

of the smuggler at zero level of smuggling is not superior to the legal world terms of trade, i.e., there is no incentive for smuggling when free trade prices prevail in domestic markets.

Returning however to an interior solution and the case of monopoly power in trade, and assuming competitive smuggling, production and consumption, we can sustain the optimal solution obtained above by:

i) consumption tax at an ad valorem rate c so that $\frac{h(x_s)}{x_s}(1+c) = h'$

ii) tariffs (subsidies) on legal imports at an ad valorem rate t so that $\frac{g(x_\ell)}{x_s}(1+t) = \frac{h(x_s)}{x_s}$

iii) production subsidies at the rate s so that $\frac{h(x_s)}{(x_s)}(1+s) = -G'$.

In this framework, if we introduce a non-economic objective of raising the production of importables X_1 to some preassigned level X_1^* in the form of a constraint $-X_1 \leq -X_1^*$, we add the expression $-\lambda_3(-X_1+X_1^*)$ to the Lagrangean and maximise. The first order conditions (7), (8), (10) and (11) continue to hold. Equation (9) gets modified to

$$\lambda_1 + \lambda_2 G' + \lambda_3 = 0. \qquad (13)$$

Of course, the solutions for C_1, C_2, X_1, X_2, x_ℓ, x_s, λ_1, λ_2 will be different with the non-economic objective present. The form of policy interventions, however, are the same:* consumption tax, tariff (subsidy) on legal imports and a production subsidy. In the presence of the non-economic objective, the production subsidy at rate s that equates $\frac{h(x_s)}{x_s}(1+s)$ to $-G'$ will be

---

*Other non-economic objectives analysed by Bhagwati-Srinivasan can be introduced in the presence of smuggling with exactly the same type of policy consequences as for the case of production analysed in the text.

higher than the consumption tax c that equates $\frac{h(x)_s}{x_s}$ (1+c) to h' since $-G' = \frac{\lambda_1}{\lambda_2} + \frac{\lambda_3}{\lambda_2} = h' + \frac{\lambda_3}{\lambda_2} > h'$, whereas in the absence of the non-economic objective the two rates will be equal.

III

While the analysis of the optimal policy mix in the presence of smuggling and monopoly power in (legal) trade that we have just set out is technically correct, it does assume the oddity that the smuggled goods be subject to consumption taxes in the same way as legally-traded goods. If we rule this out, and assume instead that smuggled goods fetch to the smuggler the tariff-inclusive price plus or minus the tax or subsidy on consumption of the legal imports and production, then the achievement of the optimal solution is impossible. We then have a second-best problem which we propose to tackle in a subsequent paper.

Instead we proceed to examine the question of the optimum level at which the tariff can be set, in the presence of smuggling, when the tariff is the only policy instrument available.* We also extend the analysis, using only the tariff as a policy variable, to questions posed by revenue as an objective.

Let us then set out the conditions of equilibrium, given a tariff rate t, in the absence of (A) and in the presence of (P) smuggling:

A		P	
$C_{1A} = X_{1A} + x_{\ell A}$	(14A)	$C_{1P} = X_{1P} + x_{\ell P} + x_{sP}$	(14P)
$C_{2A} = G(X_{1A}) - g(x_{\ell A})$	(15A)	$C_{2P} = G(X_{1P}) - g(x_{\ell P}) - h(x_{sP})$	(15P)

*This is a problem of policy relevance as a number of LDC's are not equipped to utilise other instruments (such as production and consumption taxes) with quite the same efficacy.

$$\frac{U_{1A}}{U_{2A}} = p_{dA}(t) \qquad (16A) \qquad \frac{U_{1P}}{U_{2P}} = p_{dP}(t) \qquad (16P)$$

$$-G'(X_{1A}) = p_{dA}(t) \qquad (17A) \qquad -G'(X_{1P}) = p_{dP}(t) \qquad (17P)$$

$$\frac{g(x_{\ell A})(1+t)}{x_{\ell A}} = p_{dA}(t) \qquad (18A) \qquad \frac{g(x_{\ell P})(1+t)}{x_{\ell P}} = p_{dP}(t) \qquad (18P)$$

$$\frac{h(x_{sP})}{x_{sP}} = p_{dP}(t) \qquad (19P)$$

As a preliminary to deriving the tariff rates that maximise revenue or welfare, let us derive the rates of change of the equilibrium values of some of the variables (denoted by a dot over the variable) with respect to changes in tariff. It can be shown that:

$$\dot{X}_{1A} = \frac{G'(1-\theta_A)}{G''(1+t)} > 0 \qquad \dot{X}_{1P} = \frac{G'}{G''}\frac{(1-\theta_P)}{(1+t)} > 0$$

$$\dot{x}_{\ell A} = \frac{\theta_A}{(1+t)\left(\frac{g'}{g} - \frac{1}{x_{\ell A}}\right)} < 0 \qquad \dot{x}_{\ell P} = \frac{-\theta_P}{(1+t)\left(\frac{g'}{g} - \frac{1}{x_{\ell P}}\right)} < 0$$

$$\dot{p}_{dA} = \frac{p_{dA}(1-\theta_A)}{(1+t)} > 0 \qquad \dot{p}_{dP} = \frac{p_{dP}(1-\theta_P)}{(1+t)} > 0$$

$$\dot{x}_{SP} = \frac{(1-\theta_P)}{(1+t)\left(\frac{h'}{h} - \frac{1}{x_{SP}}\right)} > 0$$

where $\theta_A = \dfrac{P_A/G'' + U_2}{P_A/G'' + U_2 - Q_A/p_{dA}}$, $\qquad \theta_P = \dfrac{P_P/G'' + U_2 - R_P/p_{dP}}{P_P/G'' + U_2 - \dfrac{(Q_P+R_P)}{p_{dP}}}$

$$P_A = (U_{11}-p_{dA}U_{21}) - p_{dA}(U_{12}-p_{dA}U_{22}) < 0$$

$$P_P = (U_{11}-p_{dP}U_{21}) - p_{dP}(U_{12}-p_{dP}U_{22}) < 0$$

$$Q_A = \frac{(U_{11}-p_{dA}U_{21}) - g'(U_{12}-p_{dA}U_{22})}{(\frac{g'}{g} - \frac{1}{x_{\ell A}})} < 0 \qquad Q_P = \frac{(U_{11}-p_{dP}U_{21}) - g'(U_{12}-p_{dP}U_{22})}{(\frac{g'}{g} - \frac{1}{x_{\ell P}})} < 0$$

$$R_P = \frac{(U_{11}-p_{dP}U_{21}) - h'(U_{12}-p_{dP}U_{22})}{(\frac{h'}{h} - \frac{1}{x_{sP}})} < 0$$

Since $U_2 > 0$, $G'' > 0$ it is clear that $0 < \theta_A, \theta_P < 1$.

(1) Maximal-revenue Tariffs: Let us first consider the maximisation of revenue: T_A, T_P. Now:

$$T_A = g(x_{\ell A})t \qquad T_P = g(x_{\ell P})t$$

$$\dot{T}_A = g + tg'\dot{x}_{\ell A} \qquad \dot{T}_P = g + tg'\dot{x}_{\ell P}$$

Let us assume that T_A and T_P attain an unique maximum at the solution of $\dot{T}_A = 0$ and $\dot{T}_P = 0$ respectively. Let us denote the solutions by t^*_{AT} and t^*_{PT}. By definition,* $\dot{T}_A \gtrless 0$ according as $t \lessgtr t^*_{AT}$ and $\dot{T}_P \gtrless 0$ according as $t = t^*_{PT}$. By substituting for $\dot{x}_{\ell A}$, $\dot{x}_{\ell P}$ in the expressions for $\dot{T}_A$ and $\dot{T}_P$ respectively we can then show that:

$$\frac{1+t}{t} \gtrless \frac{\theta_A \frac{g'}{g}}{(\frac{g'}{g} - \frac{1}{x_{\ell A}})} \quad \text{according as } t \lessgtr t^*_{AT};$$

$$\frac{1+t}{t} = \frac{\theta_P \frac{g'}{g}}{(\frac{g'}{g} - \frac{1}{x_{\ell P}})} \quad \text{according as } t \lessgtr t^*_{PT}.$$

(2) Optimal Tariffs: Denoting the welfare levels achieved in the absence and in the presence of smuggling by U_A and U_P, we can next show that:

---

*This is true, in general, only for values of t in a neighbourhood of t^*_{AT} and t^*_{PT} respectively.

$$\dot{U}_A = U_2\{p_{dA}-g'\}\dot{x}_{\ell A} \; ; \quad \dot{U}_P = U_2[(p_{dP}-g')\dot{x}_{\ell P} + (p_{dP}-h')\dot{x}_{XP}]$$

Let us assume that U_A and U_P attain their unique maximum at the solution t^*_{AU} and t^*_{PU} respectively of $\dot{U}_A = 0$ and $\dot{U}_P = 0$. Then, by definition, $\dot{U}_A \gtreqless 0$ according as $t \lesseqgtr t^*_{UA}$ and $\dot{U}_P \gtreqless 0$ according as $t \lesseqgtr t^*_{UP}$. By substituting for $\dot{x}_{\ell A}$, $\dot{x}_{\ell P}$, $\dot{x}_{SP}$ in the expression for $\dot{T}_A$ and $\dot{T}_P$ respectively, we can thus show that:

$$\frac{1+t}{t} \gtreqless \frac{\frac{g'}{g}}{\frac{g'}{g} - \frac{1}{x_{\ell A}}} \quad \text{according as } t \lesseqgtr t^*_{UA} \; ;$$

$$\frac{1+t}{t} \gtreqless \frac{(1-\theta_P)\frac{g'}{g} - \theta_P\{\frac{g'}{g} - \frac{1}{x_{\ell P}}\}\frac{h}{g}}{(\frac{g'}{g} - \frac{1}{x_{\ell P}})\{(1-\theta_P)-\theta_P\frac{h}{g}\}} \quad \text{according as } t = t^*_{UP}$$

These inequalities hold in a neighborhood of t^*_{AT} and t^*_{PT} respectively.

We can now proceed to answer the questions which we posed in the introduction:

I: Comparison of Maximal-revenue and Optimal Tariffs in the Absence of Smuggling:

This implies ranking t^*_{AT} and t^*_{AU}; and, as is already known from Johnson's classic analysis [3] , $t^*_{AT} > t^*_{AU}$. This follows because $\frac{1+t}{t}$ is a decreasing function of t; t^*_{AT} and t^*_{AU} are the solutions of

$$\frac{1+t}{t} = \frac{\theta_A\frac{g'}{g}}{(\frac{g'}{g} - \frac{1}{x_{\ell A}})} \quad \text{and} \quad \frac{1+t}{t} = \frac{\frac{g'}{g}}{(\frac{g'}{g} - \frac{1}{x_{\ell A}})} \; ;$$

and θ_A lies between 0 and 1.

II: Comparison of Optimal Tariffs in the Presence and in the Absence of Smuggling:

We can see that, for constant-elasticity offers such that $\eta_g = \frac{xg'(x)}{g(x)}$ is constant for all $x \geq 0$, $t^*_{PU} < t^*_{AU}$: i.e. the optimal tariff in the presence of smuggling is less than in the absence of smuggling. This follows from the facts that $t^*_{AU} = (\eta_g - 1)$ and $t^*_{PU} = (\eta_g - 1)(1 - \theta\frac{h}{g}) < \eta_g - 1$. However, η_g is in general a function of the particular x at which it is evaluated: hence, in general, we cannot rank t^*_{AU} and t^*_{PU}.

III: Comparison of the Maximal-revenue and Optimal Tariffs in the Presence of Smuggling:

We can show that, with smuggling $t^*_{PT} > t^*_{PU}$: i.e. the maximal-revenue tariff is higher than the optimal tariff, just as in the (traditional) case without smuggling. Note that t^*_{PT} and t^*_{PU} are respectively solutions of

$$\frac{1+t}{t} = \frac{(\frac{g'}{g})\theta_P}{\frac{g'}{g} - \frac{1}{x_{\ell P}}} \quad \text{and} \quad \frac{1+t}{t} = \frac{(1-\theta_P)\frac{g'}{g} - \theta_P \frac{h}{g}(\frac{g'}{g} - \frac{1}{x_{\ell P}})}{(\frac{g'}{g} - \frac{1}{x_{\ell P}})\{(1-\theta_P) - \theta_P \frac{h}{g}\}} .$$

Further, $\frac{1+t}{t}$ is a decreasing function t. It can be shown that, when $t = t^*_{PU}$, $\frac{1+t^*_{UP}}{t_{UP^*}} > \frac{\theta_P \frac{g'}{g}}{(\frac{g'}{g} - \frac{1}{x_{\ell P}})}$. Since $\frac{\theta_P \frac{g'}{g}}{(\frac{g'}{g} - \frac{1}{x_{\ell P}})}$ crosses $\frac{1+t}{t}$ from below at $t = t^*_{PT}$, we can conclude that $t^*_{PT} > t^*_{PU}$. Figure (2) illustrates the situation.

IV: Comparison of Maximal-revenue Tariffs in the Presence and in the Absence of Smuggling:

As we noted earlier,

$$\frac{1+t^*_{PT}}{t^*_{AT}} = \frac{\theta_A \frac{g'}{g}}{(\frac{g'}{g} - \frac{1}{x_{\ell A}})} = \frac{\theta_A \eta_g}{\eta g - 1} \quad \text{and} \quad \frac{1+t^*_{PT}}{t^*_{PT}} = \frac{\theta_P \frac{g'}{g}}{\frac{g'}{g} - \frac{1}{x_{\ell P}}} = \frac{\theta_P \eta_g}{\eta g - 1} .$$

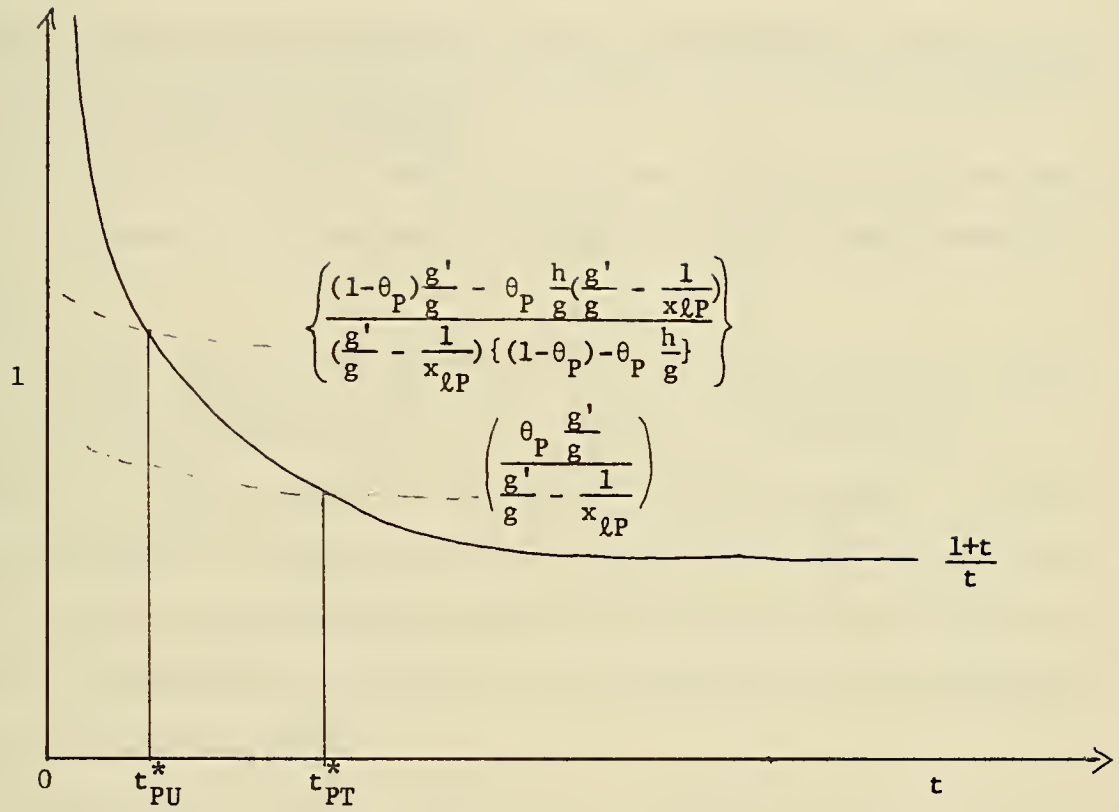

1
$\left\{\frac{(1-\theta_P)\frac{g'}{g} - \theta_P \frac{h}{g}(\frac{g'}{g} - \frac{1}{x_{\ell P}})}{(\frac{g'}{g} - \frac{1}{x_{\ell P}})\{(1-\theta_P) - \theta_P \frac{h}{g}\}}\right\}$
$\left(\frac{\theta_P \frac{g'}{g}}{\frac{g'}{g} - \frac{1}{x_{\ell P}}}\right)$
$\frac{1+t}{t}$
0
t^*_{PU}
t^*_{PT}
t

Figure (2)

Now θ_A and θ_P involve second derivatives of the welfare and transformation functions and in general we cannot assert anything about the ratio of θ_A to θ_P. Thus even if we were to assume that η_g is a constant, we cannot rank t^*_{AT} and t^*_{PT} and this conclusion holds a fortiori if η_g was not a constant.

V: Comparison of Revenue Collected, Given the Tariff Rate, in the Presence and in the Absence of Smuggling:

We may now investigate whether the revenue collected, given the tariff rate, will reduce in the presence of smuggling. This is readily shown as follows.

First, we can show that $x_{\ell A}$ reduces as the tariff increases. Let $\bar{t}$ be the tariff that reduces $x_{\ell A}$ to zero. Clearly $\bar{t}$ is determined by $(1+\bar{t})g'(0) = -G'(X_1^*)$ where X_1^* is the output of X_1 under autarky.* Let us confine ourselves to tariffs in the range $(0, \bar{t})$. Given our assumptions about G, U and g already made and assuming further that neither good is inferior, corresponding to any tariff t there exists an unique equilibrium in the absence of smuggling.

Consider now a tariff t under which an equilibrium exists in the absence as well as in the presence of a smuggling. It is clear that $p_{dP}(t) < p_{dA}(t)$. For if $p_{dP}(t) \geq p_{dA}$, then:

(i): (17A) and (17P) will imply $X_{1A} \leq X_{1P}$ since $G'' < 0$;

(ii): (18A) and (18P) will imply $x_{\ell A} \leq x_{\ell P}$ since $\frac{g(x)}{x}$ is an increasing function of x;

(iii): by assumption, $x_{sP} > 0$; and

---

*Implicitly we are assuming $g'(0) < -G'(X_1^*)$. This simply means that there is an incentive to import commodity 1 at the autarky point, if there is no tariff.

(iv): (14A), (14P), (15A) and (15P) will imply $C_{1A} < C_{1P}$ and $C_{2A} > C_{2P}$. However, given the concavity of U and non-inferiority of either good, $C_{1A} < C_{1P}$, $C_{2A} > C_{2P}$ will imply $\frac{U_{1A}}{U_{2A}} = p_{dA} > \frac{U_{1P}}{U_{2P}} = p_{dP}$, contradicting the assumption that $p_{dP} \geq p_{dA}$.

Thus, for the same tariff, $p_{dP} < p_{dA}$ and consequently $x_{\ell P} < x_{\ell A}$. Since at $t = \bar{t}$, $x_{\ell A} = 0$ it follows that (the maximal tariff $\bar{\bar{t}}$) for co-existence of smuggling and legal trade will be less than t. Let us now confine our attention to tariffs in the interval $(0, \bar{\bar{t}})$. Clearly at $t = \bar{\bar{t}}$, $x_{\ell P} = 0$ and $x_{\ell A} > 0$.

From the above, it immediately follows that given a tariff, the revenue that can be collected in the presence of smuggling is less than the revenue in the absence of smuggling. For the same tariff, the equilibrium domestic price ratio and legal imports are higher in the absence of smuggling: hence the tariff revenue will be higher. This also means that the maximum tariff revenue that can be collected is greater in the absence of smuggling. However, as we have already argued, we cannot in general rank the tariff rates that generate maximum revenue in the two cases.

VI: Comparison of Tariff Rates Generating Given Revenue, in the Presence and in the Absence of Smuggling:

We may now investigate yet another problem: in generating a given, feasible revenue, can we argue that smuggling will require necessarily a higher or a lower tariff than if smuggling were not possible?

To analyse this question, consider any tariff revenue $\bar{T}$ that can be collected in the presence and absence of smuggling. If we assume that the revenue $\{T_A(t), T_P(t)\}$ collected by a tariff to increase, reach a maximum

and then decrease as t increases,* there will be pairs of tariffs $(\hat{t}_A, \hat{\hat{t}}_A)$ and $(\hat{t}_P, \hat{\hat{t}}_P)$ that yield $\overline{T}$. Since $T_A(t) > T_P(t)$ for all relevant t, it is clear that $\hat{t}_A \leq t_{AT} \leq \hat{\hat{t}}_A$, $\hat{t}_P \leq t_{PT} \leq \hat{\hat{t}}_P$ and $\hat{t}_A < \hat{t}_P \leq \hat{\hat{t}}_P < \hat{\hat{t}}_A$. Thus, of the two tariffs that collect a given revenue in the absence of smuggling, the lower one is less than the lower tariff that collects the same revenue in the presence of smuggling and the higher one is larger than the higher one.

IV

We now examine the impact of smuggling on Lerner's "symmetry theorem" [14]. According to this theorem, it makes no (real) difference whether a tariff is levied on the exportable or the importable good.

This theorem would carry over, in the case of smuggling, if there were a unique smuggling transformation curve. This is, however, not a plausible assumption. The cost of smuggling will vary with its feasibility: which must depend, in turn, on the physical characteristics of the commodity. It follows therefore that an export tax at the same rate as an import tax could, and generally would, lead to differential results thanks to the differential impact of each on the smuggling transformation curve.

V

The fact of differential smuggling feasibilities among different tradeable goods has a bearing also on the question of optimal policy structures.

---

*This is an additional restriction to those we have specified earlier: in general, there is no reason to assume that the revenue collected is not identical at more than two values.

Bhagwati and Srinivasan [1] have analysed four non-economic objectives--production, consumption, import-level and factor employment in a sector--and shown that each is optimally achieved by policies which affect the relevant market--production, consumption, trade and factor-use tax-cum-subsidies, respectively. Vandendorpe [5], in a brilliant recent paper, has extended this analysis to a multiple-good model to show that the same policies carry over and that the optimal policy structures would require uniform tax rates.

Thus, if the government desires to reduce overall imports by a fixed value, the prescription for a small country is to use uniform tariff rates on each importable. However, smuggling will generally be characterised by non-constant costs, so that (as Vandendorpe shows for the case of monopoly power in trade) the optimal policy structure will cease in general to be uniform.*

---

*A formal analysis of this problem could further distinguish between the level of total and the level of legal imports.

REFERENCES

[1] Bhagwati, J. and T. N. Srinivasan. "Optimal Intervention to Achieve Non-Economic Objectives," Review of Economic Studies, XXXVI (January 1969).

[2] Bhagwati, J. and Bent Hansen. "A Theoretical Analysis of Smuggling," Quarterly Journal of Economics (forthcoming, 1973).

[3] Johnson, H. G. "Optimum Welfare and Maximum Revenue Tariffs," Review of Economic Studies, XIX (1), No. 48 (1950-51).

[4] Lerner, A. P. "The Symmetry Between Import and Export Taxes," Economica, N. S. Vol. 3 (August 1936).

[5] Vandendorpe, A. "On the Theory of Optimal Policy Structures in an Open Economy," Journal of International Economics (forthcoming, 1973).

Date Due

DEC 15 '75

OCT 20 '76

JAN 01 '77

MAR 25 '77

JUN 02 '77
NOV 17 '77

DEC 27 '77

AUG 04 '78

SEP 28 '78

DEC 5 '79

MAY 13 '79

JUN 12 '79

MAR 29 '80

MAR 19 '81

OCT 18 '88

DE 27 '88

NOV 14 1991

NOV 23 2001

Lib-26-67

MIT LIBRARIES
3 9080 003 960 017
MIT LIBRARIES
3 9080 003 929 004
MIT LIBRARIES
3 9080 003 959 993
MIT LIBRARIES
3 9080 003 959 951
MIT LIBRARIES
3 9080 003 928 972
MIT LIBRARIES
3 9080 003 928 998
MIT LIBRARIES
3 9080 003 959 928
MIT LIBRARIES
3 9080 003 929 020
MIT LIBRARIES
3 9080 003 959 985